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TITLE: Casing package material for thin shaped polymer battery in electronic machine - obtained by sequential lamination of adherence layers, short prevention layer, barrier metallic layer and protective layer

PATENT-ASSIGNEE: RICOH KK[RICO]

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PATENT-FAMILY:

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ABSTRACTED-PUB-NO: JP 11067168A

BASIC-ABSTRACT:

NOVELTY - The casing package material (31) is a multilayered structure, obtained by sequential lamination of adherence layers (45,46), shorting prevention layer (44), barrier metallic layer (43) and a protective layer (41).
Adherence layer and cementing layer (42b) are formed between respective layers.

DETAILED DESCRIPTION - The protective layer (41) containing polyethylene terephthalate is formed for maintaining strength of the casing package material. The barrier metal layer contains aluminum foil. The adherence layers (45,46) are formed of low density polyethylene and ionomer respectively.

USE - For portable telephone, office automated apparatus, communication apparatus.

ADVANTAGE - Prevents short circuit of inner battery component of battery by sealing inner component and inserting into casing packaging material. Short prevention layer eliminates air penetration through pin-holes. Prevents performance degradation due to electrolyte leakage.

DESCRIPTION OF DRAWING(S) - The figure depicts sectional drawing indicating lamination structure of casing packaging material for battery. (31) Casing package material; (41) Protective layer; (42b) Cementing layer; (43) Barrier metallic layer; (44) Short prevention layer; (45,46) Adherence layers.

CHOSEN-DRAWING: Dwg.7/13

TITLE-TERMS: CASING PACKAGE MATERIAL THIN SHAPE POLYMER BATTERY ELECTRONIC MACHINE OBTAIN SEQUENCE LAMINATE ADHERE LAYER SHORT PREVENT LAYER BARRIER METALLIC LAYER PROTECT LAYER

DERWENT-CLASS: A85 L03 X16

CPI-CODES: A05-E04E; A11-B09A2; A12-E06C; L03-E01D;

EPI-CODES: X16-B01F; X16-F01;

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates in detail about a thin shape polymer battery to the sheathing structure of a thin shape cell, i.e., the structure of sheathing prepuce material (housing package material).
[0002]
[Description of the Prior Art] Development of an electronics field in recent years is remarkable, and its demand of the miniaturization of electronic equipment, lightweight-izing, and highly-efficient-izing is remarkable. The cell called heart of electronic equipment is expected development of a cell with it. [per unit volume or the large and energy density per unit weight, and] [long lasting] Under such circumstances, use expansion of the lithium ion rechargeable battery to a cellular phone, small OA equipment, a small transmitter, etc. is expected.
[0003] Conventionally, the primary cell or rechargeable battery for current supply which is form variously is carried in small electronic equipment, such as handicap type a video camera and a cordless telephone, and a cellular phone. It charges, and when it carries repeatedly the rechargeable battery which can be used in these electronic equipment etc., in order to make easy the attachment and detachment to battery chargers, such as electronic equipment, etc., the cell equipment which dedicated the singular number or two or more rechargeable batteries to one case is used. This cell equipment (not shown) consists of a cell container which consists of plastic material etc. and which is formed in general in the shape of a method object of merit, and the singular number contained in this cell container or the rechargeable battery in which two or more charge electric discharge is possible.
[0004] Since it carries in electronic equipment, etc. the device for charge, etc., such cell equipment has the anode terminal and the cathode terminal, and supplies the power stored in the rechargeable battery when carried in electronic equipment etc. to electronic equipment etc. from an anode terminal and a cathode terminal. This rechargeable battery is formed by packing with separator 13 and piling up the positive-electrode board 11 and the negative-electrode board 12 by turns, as shown in drawing 10 .
[0005] And after [for which the layered product which consists of this positive-electrode board 11, a negative-electrode board 12, and separator 13 of a saccate is not illustrated] inserting in the dc-battery case of the method object of merit in general, and pouring in the electrolytic solution or forming a solid polymer electrolyte and a gel electrolyte between the positive-electrode board 11 and the negative-electrode board 12 beforehand, it is operated as a rechargeable battery by inserting in a dc-battery case. Drawing of current is performed by positive-electrode terminal 14a and negative-electrode terminal 14b. both sides of the charge collector 21 which consists of an aluminum foil with a thickness of about 20 micrometers with a rectangle as the aforementioned positive-electrode board 11 is shown in drawing 11 -- the multiple oxide 2O5 of a lithium and transition metals, for example, LiV, LiCoO2, and LiNiO2 LiMn 2O4 etc. -- it considers as a positive active material 22, and application **** is carried out
[0006] On the other hand, with the rectangle shown in drawing 11 , the aforementioned negative-electrode board 12 makes the carbon which has, the carbon, for example, the graphite structure, in which a dope and a ** dope of a lithium ion are possible to both sides of the charge collector 23 which consists of copper foil with a thickness of about 10 micrometers, such as carbon and ********** material, the negative-electrode active material 24, and carries out application dryness. Moreover, a porous polyethylene film and a porous polypropylene film with a thickness of about 25 micrometers are used for separator 13, making them into a saccate.
[0007] It sets to drawing 11 and is LiPF6 as an electrolyte 25, for example to the mixed solvent of ethylene carbonate (EC) and dimethyl carbonate (DMC). It is [the dissolved nonaqueous electrolyte and] LiBF4 in the aforementioned solvent. Or LiN2 (CF3 SO2) The macromolecule gel electrolyte which gelled them, using the dissolved nonaqueous electrolyte is used. The combination of positive-electrode board 11 / electrolyte 25 / separator 13 / electrolyte 25 / negative-electrode board 12 as shown in drawing 11 is called cell power generation element.
[0008] Although the beginning also described, the cell power supply is increasingly asked for the high-energy density per weight, the high-energy density per volume, long lasting, and high-reliability in recent years, and the thin shape cell is proposed for realization of a small, lightweight, and thin cell. A power generation element flat in order that a thin shape cell may make the thickness thin as much as possible conventionally In carrying out sheathing of **** and the cell power generation element are carrying out sheathing airtightly and using especially nonaqueous electrolyte by the laminate film (housing package material) which has a metallic foil and a heat weld resin film Since the fall of the performance degradation

by penetration of the moisture in the open air to a power generation element, oxygen, and nitrogen and disclosure of the electrolytic solution to the open air or safety is large, much proposals are made.
[0009] The cross section showing the sheathing structure (example of sheathing by the laminate film) of the flat type thin shape cell of the former [drawing 12] and drawing 13 are the cross sections showing the laminated structure of housing package material. The ionomer film 2 is laminated at the rear face of the substrate 1 made from stainless steel, the electrically-conductive-glass substrate 3 and a power generation element are laid through the positive-electrode side lead object 9 on this ionomer film 2, and the aluminum foil laminate film 7 is further covered with this thin shape cell through the negative-electrode side lead object 8 on this power generation element. The aforementioned power generation element consists of a positive electrode 4, a solid electrolyte 5, and a negative electrode 6.
[0010] The aforementioned aluminum foil laminate film 7 laminates ionomer film 7b as a heat weld nature resin film in the inside of aluminum foil 7a, as shown in drawing 13 , and it laminates polyester film 7c as a protection film of aluminum foil 7a outside (JP,60-211762,A).
[0011] Thus, by the thin shape cell of drawing 12 , the heat weld film of polyester is laminated at the rear face of the substrate of a functional device, after arranging a cell power generation element, the heat weld nature resin film of an ionomer is put on a medial surface, heat weld of the heat weld film laminated in the substrate and the heat weld nature resin film of a metallic foil laminate film is carried out, and it has closed.
[0012]
[Problem(s) to be Solved by the Invention] However, by the thin shape cell of JP,60-211762,A, there was a fault of short-circuiting though weld of the weld section is ensured. That is, when a pinhole occurred on the heat weld nature resin film of a medial surface, it short-circuited electrically between the metallic foil, the charge collector, or the terminal, and when the worst, there was a fault of igniting. Moreover, when heat weld of the housing package material was carried out, there was a fault that a terminal will contact a metallic foil and will short-circuit in the seal edge section. this invention is made in view of such a technical problem.
[0013] this invention person thought that what is necessary was just to make another film intervene between a metallic foil and a heat weld nature resin film, in order to lose the aforementioned short-circuit. Then, when nylon and the ethylene-vinyl alcohol polymer were made to intervene, the battery life fell. Such a result originates in the hygroscopicity of nylon and an ethylene-vinyl alcohol polymer, and it turns out that these films are not employable at the lithium cell which dislikes moisture.

[0014] By the way, polyester (polyester system heat weld nature resin) does not have hygroscopicity, and excelling also in the solvent resistance to a solvent which is used for an electrolyte is known. However, since the adhesive property of polyester with a metallic foil is bad, you have to make adhesives placed between the interfaces of polyester film and a metallic foil. However, generally, swelling in nonaqueous electrolyte was known, and although the electrolytes of a thin shape polymer battery are liquid and gel, since an electrolyte component existed, polyester had a possibility that adhesives might exfoliate to have made it intervene.
[0015] therefore, in a thin shape polymer battery, even when a pinhole occurs on the heat-resistant-resin film outside the metallic foil of housing package material, the purpose of this invention There is no fear of a metallic foil being **(ed) by the open air and short-circuit with a terminal and penetration of the open air occurring. When there is also no advance of the interior element of a cell and a pinhole moreover occurs to an inside heat weld nature resin, while being able to prevent short-circuit with a metallic foil and a charge collector, it is offering the sheathing prepuce material which was made not to be invaded by the electrolyte component of liquid and a gel electrolyte.
[0016]
[Means for Solving the Problem] By this invention, by the housing package material of two sheets, the housing package material of one sheet inserted into two, or the housing package material of one sheet inserted into the saccate two In the thin shape polymer battery which pasted up and sealed housing package material around housing package material on both sides of the interior element of a cell, respectively For example, as shown in drawing 7 , the laminating of the aforementioned housing package material is carried out to the order of a protective layer 41, adhesives layer 42a, the barrier metal layer 43, the short prevention layer 44, glue-line layer 42b, and an adhesion layer, and it is constituted.
[0017] Namely, adhesives layer 42a for adhesive improvement of the protective layer 41 for the housing package material 31 shown in drawing 7 maintaining intensity from (1) outside, the barrier metal layer 43 of the metallic foil of (2) grounds, and the (3) protective layer 41 and the barrier metal layer 43, (3) Glue-line layer 42b for adhesive improvement with the short prevention layer 44 for the pinhole prevention inside the barrier metal layer 43, (4) barrier metal layer 43, and the short prevention layer 44, And it is constituted by the adhesion layer for raising the electrolytic-solution-proof nature inside (5) glue-line layer 42b.
[0018] Moreover, with the ionomer film (52 54) which is a heat weld nature resin film about ** adhesives layers 42a and 42b with the polyethylene-terephthalate film (51) which is a heat-resistant-resin film about the ** protective layer 41 as the aforementioned housing package material 31 shows, for example to drawing 8 , ** barrier metal layer 43 is formed with an aluminum foil 53, and ** short prevention layer 44 is formed with a polyethylene-terephthalate film (55), respectively.
[0019] The aforementioned adhesion layer (see drawing 7 and drawing 8) is made into the two-layer structure which consists of the 1st adhesion layer 45 and the 2nd adhesion layer 46, for example. the good line of electrolytic-solution-proof nature with an adhesive property sufficient [the 1st adhesion layer 45] with the short prevention layer 44 which consists of a polyethylene terephthalate 51 -- it considers as a low density polyethylene (LLDPE) 56, and an adhesive property with this

LLDPE and electrolytic-solution-proof nature improves [an adhesive property with a terminal metal] the 2nd adhesion layer 46 as the good ionomer 57 Thus, the housing package material 31 shown in drawing 7 is taken as the laminated structure which consists of seven layers of a protective layer 41 (outermost layer of drum) - the 2nd adhesion layer 46 (innermost layer).

[0020] Namely, a polymer battery (see drawing 2 , 7, and drawing 11) according to claim 1 The interior element of a cell which the positive-electrode board 11 and the negative-electrode board 12 are made to counter by turns through the electrolyte layer 25 and the separator 13 which may be omitted, and becomes in piles is put by the housing package material 31. In the cell constituted by welding housing package material around the housing package material 31, and sealing the interior element of a cell, the housing package material 31 is characterized by being the gestalt which carried out the laminating to the order of a protective layer 41, the barrier metal layer 43, the short prevention layer 44, and an adhesion layer at least from the outer layer side.

[0021] A polymer battery according to claim 2 is characterized by having put the interior element of a cell by the housing package material of two sheets, having welded housing package material around housing package material, and sealing the interior element of a cell in a claim 1.

[0022] A polymer battery according to claim 3 is characterized by having put by the housing package material of one sheet which inserted the interior element of a cell into two, having welded housing package material by three sides of housing package material, and sealing the interior element of a cell in a claim 1.

[0023] A polymer battery according to claim 4 is characterized by a protective layer being a heat-resistant film in claims 2 or 3.

[0024] A polymer battery according to claim 5 is characterized by the heat-resistant film of a protective layer being a polyethylene-terephthalate film in a claim 4.

[0025] A polymer battery according to claim 6 is characterized by the adhesives of the interface of a protective layer and a barrier metal layer being ionomers in claims 2 or 3.

[0026] A polymer battery according to claim 7 is characterized by a barrier metal layer being an aluminum foil in a claim 1.

[0027] A polymer battery according to claim 8 is characterized by the adhesives of the interface of a barrier metal layer and a short prevention layer being ionomers in claims 2 or 3.

[0028] A polymer battery according to claim 9 is characterized by a short prevention layer being a heat-resistant film in claims 2 or 3.

[0029] A polymer battery according to claim 10 is characterized by the heat-resistant film of a short prevention layer being a polyethylene-terephthalate film in a claim 9.

[0030] A polymer battery according to claim 11 is characterized by the adhesion layer being two-layer at least in claims 2 or 3.

[0031] a polymer battery according to claim 12 -- a claim 11 -- setting -- an adhesion layer -- a line -- it is characterized by consisting of two-layer [of a low density polyethylene (LLDPE) and an ionomer]

[0032] A polymer battery according to claim 13 is characterized by constituting, when the interior element of a cell puts by the housing package material of one sheet of housing package material which welded to the outside field in respect of the inside most, and was most inserted into tubed, welds housing package material by two sides of housing package material and seals the interior element of a cell in a claim 11.

[0033] A polymer battery according to claim 14 is characterized by outside adhesives being [of housing package material] ionomers most in a claim 13.

[0034]

[Example] Hereafter, the example of this invention is explained, referring to a drawing.

Example 1 (claims 1 and 2)

The perspective diagram in which drawing 1 shows the structure of a cell, and drawing 2 are the A-A' line cross sections of drawing 1 . This cell puts the interior element of a cell shown in drawing 10 by the housing package material 31 and 31 of two sheets, seals the interior element of a cell and consists of welding the housing package material 31 and 31 of these in the circumference (32 being the weld section and 33 being a weld side). Ejection of current is performed by positive-electrode terminal 14a and negative-electrode terminal 14b.

[0035] both sides of the charge collector 21 which consists of an aluminum foil with a thickness of about 20 micrometers with a rectangle as the positive-electrode board 11 is shown in drawing 11 -- the multiple oxide 2O5 of a lithium and transition metals, for example, LiV, LiCoO2, and LiNiO2 LiMn 2O4 etc. -- it considers as a positive active material 22, and application dryness is carried out

[0036] On the other hand, with the rectangle shown in drawing 11 , the negative-electrode board 12 makes the carbon which has, the carbon, for example, the graphite structure, in which a dope and a ** dope of a lithium ion are possible to both sides of the charge collector 23 which consists of copper foil with a thickness of about 10 micrometers, such as carbon and ********** material, the negative-electrode active material 24, and carries out application dryness.

[0037] Moreover, in drawing 11 , a porous polyethylene film and a porous polypropylene film with a thickness of about 25 micrometers are used for separator 13, making them into a saccate. An electrolyte 25 is LiPF6 to the mixed solvent of ethylene carbonate (EC) and dimethyl carbonate (DMC). It is [the dissolved nonaqueous electrolyte and] LiBF4 in the aforementioned solvent. Or LiN2 (CF3 SO2) The macromolecule gel electrolyte which gelled them, using the dissolved nonaqueous electrolyte is used.

[0038] The cell consists of this example by putting the cell power generation element made into the combination structure of the 25/separator 13 of 11/electrolytes of positive-electrode boards/the 25/negative-electrode board 12 of electrolytes by the housing package material 31 and 31, welding these around the housing package material 31 and 31, and sealing the interior element of a cell.
[0039] Drawing 7 is the cross section showing the laminated structure of the housing package material 31 of seven layer structures, and shows the function of each layer. Drawing 8 is the cross section showing an example of the material which forms each class of this housing package material 31. The housing package material 31 of drawing 7 serves as a gestalt which carried out the laminating to the order of a protective layer 41, adhesives layer 42a, the barrier metal layer 43, adhesives layer 42b, the short prevention layer 44, and an adhesion layer (it is two-layer [of the 1st adhesion layer 45 and the 2nd adhesion layer 46]) from the outside.
[0040] If it explains concretely using drawing 7 and drawing 8 , a protective layer 41 will be a heat-resistant film with a thickness of 20 micrometers, and will consist of a polyethylene terephthalate 51. Adhesives layer 42a of the interface of a protective layer 41 and the barrier metal layer 43 consists of an ionomer 52 which is a heat weld resin film. The barrier metal layer 43 is the aluminum foil 53 with a thickness of 30-100 micrometers. Adhesives layer 42b of the interface of the barrier metal layer 43 and the short prevention layer 44 consists of an ionomer 54. The short prevention layer 44 is a heat-resistant film, and consists of a polyethylene terephthalate 55.
[0041] the 1st adhesion layer 45 -- a line -- it consists of a low density polyethylene (LLDPE) 56, and the 2nd adhesion layer 46 consists of an ionomer 57 Since the aforementioned weld side 33 (see drawing 2) is based on ionomers (ionomers 57 and 57), its weld force is highly uniform. Moreover, the adhesion of an ionomer 57, and positive-electrode terminal 14a and negative-electrode terminal 14b (all are the products made from nickel) is also good.
[0042] Example 2 (claim 3)
The perspective diagram in which drawing 3 shows cell structure, and drawing 4 are the B-B' line cross sections of drawing 3 . This cell puts the interior element of a cell by the housing package material 31 of one sheet inserted into two, and is constituted by welding housing package material in the weld section 32 of three sides of the housing package material 31, and sealing the interior element of a cell.
[0043] Example 3 (claim 13)
The perspective diagram in which drawing 5 shows cell structure, and drawing 6 are the C-C' line cross sections of drawing 5 . This cell puts the interior element of a cell by the housing package material 31 of one sheet of the housing package material 31 which welded most the inside field (the 2nd adhesion layer 46 which consists of an ionomer 57) to the outside field (protective layer 41 which consists of a polyethylene terephthalate 51), and was most inserted into tubed, by welding housing package material by two sides of the housing package material 31, seals the interior element of a cell and is constituted. Since the adhesive property of a polyethylene terephthalate 51 and an ionomer 57 is comparatively good, it can form the weld side 33 of a good weld state by welding these. In addition, since housing package material can be welded by adhesion of ionomers if the laminating of the ionomer 61 is carried out on a polyethylene terephthalate 51 (protective layer 41) as shown in drawing 9 , the adhesive strength of the aforementioned adhesion side increases further.
[0044] In addition, although the polyethylene terephthalate was used for the protective layer in the example, you may be OPP (extension polypropylene) or NY (polyamide). OPP or PAN (polyacrylonitrile) may be used for a short prevention layer, or EMAA may be used for an adhesion layer. Moreover, if hygroscopicity, bloating tendency, electrolytic-solution-proof nature, an adhesive property, and lamination are taken into consideration, PP, PE, CPP, EMA, EVA, etc. are usable. Furthermore, nickel foil can also be used as a barrier metal layer. Moreover, although separator was used in the example of this invention, even if it omits separator, it is uninfluential in the effect by this invention in any way.
[0045]
[Effect of the Invention] As mentioned above, according to this invention, the following effects are acquired as explained.
(1) Put the interior element of a cell which claims 1-3, 13 positive-electrode board, and a negative-electrode board are made to counter by turns through an electrolyte layer and the separator which may be omitted, and becomes in piles by housing package material. In the cell constituted by welding housing package material around housing package material, and sealing the interior element of a cell Since housing package material was made into the structure which carried out the laminating to the order of a protective layer (outside protective layer), a barrier metal layer, a short prevention layer, and an adhesion layer at least from the outside It puts by housing package material and housing package material is welded around housing package material, and when the interior element of a cell is sealed and constituted, short-circuit of the interior element of a cell can be prevented.
[0046] (2) Since the claim 5 and the outside protective layer of housing package material were formed with the polyethylene-terephthalate film which is a heat-resistant-resin film, the intensity as a cell increases.
[0047] (3) Since the ionomer glue line which is a heat weld nature resin film was prepared in order to improve the adhesive property of the barrier metal layer of the metallic foil of six to claim 10 ground, and a protective layer, even when a pinhole occurs on the heat-resistant-resin film outside the metallic foil of housing package material, it is lost that a metallic foil is **(ed) by the open air, short-circuit with a terminal occurs or penetration of the open air and advance of the interior element of a cell occur. Moreover, since the adhesive property of a polyethylene terephthalate and an ionomer is good, the safety of a cell improves. Moreover, since the short prevention layer which consists of a polyethylene terephthalate inside a barrier metal layer was prepared and the ionomer has been arranged as a glue line of a barrier metal layer and a short prevention layer, when a pinhole occurs to an inside heat weld nature resin, short-circuit with a metallic foil and a charge collector can be

prevented.
[0048] (4) the cell of claim 11 this invention -- housing package material -- electrolytic-solution-proof nature and an adhesive property -- and In consideration of the hygroscopicity and bloating tendency which is the factor of minus, selected for the interior element of a cell. While constituting a cell by considering as the laminated structure of seven or more layers combined by the optimal lamination by heat-resistant-resin material and weld nature resin material, welding housing package material, and sealing the interior element of a cell Sheathing of the flat power generation element for realization of a small, lightweight, and thin cell was carried out to fluid-tight and the airtight by the housing package material which has a metallic foil and a heat weld resin film. For this reason, in losing the fall of the performance degradation and the safety resulting from these and both energy densities' becoming high per the energy density per weight, and volume since the penetration to the power generation element of the moisture, oxygen, and nitrogen in the open air and electrolytic-solution disclosure out of a cell can be prevented exactly conventionally unlike the cell of structure when sheathing of the cell power generation element using nonaqueous electrolyte is carried out, long lasting and high-reliability are acquired.
[0049] (5) the good line of electrolytic-solution-proof nature with a sufficient adhesive property with the short prevention layer of claim 12 polyethylene terephthalate -- since the adhesive property with a terminal metal constituted the aforementioned adhesion layer with the adhesive property of the 1st adhesion layer which consists of a low density polyethylene (LLDPE), and this LLDPE, and sufficient electrolytic-solution-proof nature by using a good ionomer as the 2nd adhesion layer, a highly efficient cell is obtained
[0050] (6) Since the cell was constituted by welding two sides (the outermost side and the maximum inside) of this housing package material, and sealing the interior element of a cell while inserting the housing package material of 131 claims into tubed and putting the interior element of a cell, the workability of cell manufacture improves.

[Translation done.]